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REFUSE COLLECTION

Report of a Subcommittee of the Committee on Refuse Collection and Disposal of the Sanitary Engineering Division

{Discussion open until December 1, 1954}

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Report of a Subcommittee of the Committee on Refuse Collection and Disposal of the Sanitary Engineering Division

This report on Refuse Collection is one of a series produced by Subcommittees of the Sanitary Engineering Division's Committee on Refuse Collection and Disposal. Other subcommittees have reported on Garbage Reduction; Dumping and Land Fill; Hog Feeding; Incineration; Composting and Grinding; and State Activities and Fiscal Aspects. These reports are being published as separates as they become available. While not consecutively issued or numbered, the reports will form a series representing the final report of the Committee on Refuse Collection and Disposal.

The committee consisted of:

Henry W. Taylor, Chairman

Norman W. Nester	Charles L. Senn
Newell L. Nussbaumer	V. M. Ehlers
Sol Pincus	Charles L. McGauhey

Members of the Subcommittee concerned are listed at the end of this and the other Subcommittee reports.

FOREWORD

In 1901, M. N. Baker made the following and now classic statements "In no branch of municipal service has so little progress been made in the United States as in the disposal of garbage. Why do such conditions exist? First, because the sanitary collection and disposal is appreciated neither by the general public nor the city officials; second, because it is seldom recognized that the problems incident to final disposal are largely engineering in character and therefore should be entrusted to engineers."

Mr. Baker's statement could be enlarged in scope by substituting "refuse" for "garbage" and adding emphasis to the need for engineering technique and administration in collection as well as in disposal methods.

Activities of this Committee on Refuse Collection and Disposal since its inception may be briefly summarized as follows:

In 1935 the Sanitary Engineering Division appointed a "Committee on Technical Aspects of Refuse Disposal" and this Committee functioned until January, 1942, during which period four reports were submitted and abstracted in Civil Engineering. The final report of this Committee stated that:

> "due to the unusual activity of members of the Committee and on account of the lack of general interest in the subject under consideration at this time, together with a feeling on the part of the Committee Members that the subject is not particularly well adapted to Committee action, it is recommended that this Committee be discontinued."

The "unusual activity" of Members of the Committee still exists. Any lack of general interest in this subject has been replaced by the pressing necessity of solving a municipal problem which places increasing demands on public officials and engineers. A new Committee was appointed in 1947 and a progress report was submitted by the Chairman, Rolph Eliassen. This progress report outlined many of the facets of this subject and the need for application of engineering technique and administration.

At the 1949 meeting of this Society, a report was submitted by the Committee on "Advancement of Sanitary Engineering," which recommended the collaboration of the personnel from other technical organizations in the activities of Committees working on projects of broad scope. The recommendation met with quick approval and the present Committee has attempted to put these recommendations into tangible form by introducing Subcommittees who operate as task groups under the leadership of the personnel of the base Committee.

A report by the Committee in January 1950 confined itself to the organization of the Committee and Subcommittees with a prospectus of objectives. A Progress Report was submitted in October 1952 and

included the efforts of seven Subcommittees.

This report for 1953 may be considered as the final report of the Committee with the objectives originally stated by this Committee. The increased activity in research, in design and operation are leading to an extensive program of literature emanating from individuals, colleges, institutions and commissions and any attempt by this Committee to include all this data would be futile and a subsequent report would be largely a bibliography of this literature. In other words, present activities have extended beyond the scope of the Committee and involve a volume of current literature from various sources which are available from their original source.

This report is actually individual reports of the seven task groups acting as Subcommittees. The Chairman has considered that each group contains acknowledged experts within the scope allotted to it and has not, in general, modified or condensed the reports as submitted by these separate Subcommittees. He has also considered that it would be impracticable for the base committee as a whole to attempt to pass on or modify the work of the individual groups since the scope of these groups includes such a varied field.

The Chairman has reduced the personnel of various Subcommittees, as stated in this report, to those who have been able to devote time and submit data to their various Subcommittee Chairman. The Chairman wishes to express his appreciation of the cooperation of the Committee and Subcommittee members.

HENRY W. TAYLOR, Chairman

ASCE Committee on
Refuse Collection and Disposal

REFUSE COLLECTION

INTRODUCTION

The proper and regular collection and disposal of refuse is of extreme importance to the health of any community. Because of the lack of interest heretofore shown by communities in collection of refuse and waste material, the problem of removal still exists and appears to present a more and more acute problem. Since the welfare and health of a community is directly affected by adequate removal of waste materials, action should be initiated by all communities to accomplish this function in the most economical and efficient manner possible.

Need

There are few municipal services which bring the taxpayer closer to municipal officials than refuse collection and disposal. The frequent and periodic visits of the refuse collector at the home of the taxpayer intimately ties the municipal administration to the occupant. Any municipality which has suffered a breakdown of refuse collection service has full realization of the hardships which develop. Municipal administrations have been known to fail as a result of poor refuse collection service. Yet, despite the vital role this service plays, it is one field which receives little or no attention in many communities.

Whereas there are a number of adequate, economic and efficient collection systems in the country, particularly in large cities, such as New York, Cincinnati, Detroit, Washington and Chicago, there exist numerous smaller communities where the collection operation is handled carelessly and inadequately.

In North Dakota, the methods employed in collection and final disposal of garbage and rubbish in a number of cities are termed "regrettable by authorities."(1) In the State of Michigan, a survey reveals that many municipalities have no system of refuse collection whatsoever.(2)

There is a general tendency in all parts of the country to neglect refuse collection on the ground that it constitutes a minor service. In a study within the state of Alabama, 51% of the municipalities reporting did not require raw garbage to be placed in closed containers, and annual costs for collection varied from $50 in one community to $300,000 in Birmingham.(3) The cost of collection in the City of Detroit annually exceeds $1,000,000. In Cincinnati, Ohio, the annual collection cost nears $1,500,000 and Toledo reports the costs of collection exceeds $200,000

Note: Please forward all comments on this report to Chairman Henry W. Taylor, 151 W. Merrick Road, Freeport, N. Y.

per year. Expenditures of these amounts of money lift the operation of refuse removal into the class of big business.

In a comprehensive study made in Ohio by the State Department of Health, 121 cities of over 5,000 population were investigated. In rating the premises where refuse storage was contained, 26% of the cities were rated "good", 18% "fair", 25% "poor", and 31% "very poor."(4)

In Maryland, a report concerning conditions found by the State Department of Health, indicates a general lack of enforcement of laws regarding garbage collection and disposal. The most discouraging part of the study is the indication that only 4 of the 44 communities expressed any desire to improve their existing unsatisfactory conditions.(5)

Lack of adequate refuse collection and disposal is not a new development. In 1921, Hering and Greeley wrote, "Collection service—rarely received the consideration from city officials which its importance deserved."(6) In 1941, an American Public Works Association Committee reported continued failure on the part of city officials to support local regulations dealing with refuse collection.(7)

Vegetable and organic material are subject to decay and during the process produce objectionable odors. While medical evidence in court has held that odors do not directly cause disease, all public health authorities agree that many diseases originate in filth and decaying matter through an intermediary acting as a carrier or host.

Uncontrolled refuse collection encourages accumulation of filth. It attracts flies and promotes fly breeding. It attracts rodents and insects which are vectors of disease.

Flies are the mechanical vector of typhoid fever, paratyphoid fever, salmonella infection and dysentery, and may be of epidemiological importance in some virus diseases. Rats are known carriers of jaundice, typhoid fever and trichinosis. In spite of this knowledge of the operation of disease carriers, many rodent control programs are jeopardized by lack of proper public handling of garbage. The programs are usually based on rodent population reduction, and seldom include a removal of harborages and food sources for the rats. Occasionally the public does expect and demand protection from any failure to control the collection of garbage and refuse. Usually however, such an occasion arises during or immediately following a virus or disease epidemic which can be indirectly traced to filth and improperly handled wastes.

In view of the foregoing evidence of careless and inadequate refuse collection and removal, why have many municipal officials neglected to discharge their responsibilities in these matters? There are a number of possible reasons all of which contribute to a faulty system. Some of these follow:

1. Effort toward proper regulation might decrease political support.
2. Fear of increasing taxes.
3. Inadequate ordinances on subject.
4. No knowledge of serious loss of life attributable to diseases resulting from refuse handling.
5. Lack of general demand by the public.
6. Simplicity of home disposal in coal stove or garden.
7. Most complaints based on odor which usually is not a legal hazard.

8. Inadequate publicity except during annual clean up periods.

Planning

Refuse collection in all its phases should be subject to engineering study, investigation and analysis. Too frequently the collection service of a municipality is supervised by men who allow the system to grow haphazardly without any effort to promote an efficient and economic service.

There are few communities which have historical data available on the collection system. Because of wide variations in environment living habits, topographical features, and climatic conditions, selection of a collection system cannot be based on theory or empirical formula. Lack of past records in most municipalities precludes the use of experience in selecting a system.

The first and most important step to a solution of an efficient and economical collection service is the need for a study and survey of existing conditions. The survey should consist of the collection-work load and refuse output and should include: the number of carry-outs or pick-ups made by the collection crew; the mileages covered on each route; and the quantity of refuse generated in each area. With the basic information collected, a trial system of routes can be instituted. Alterations in routes will be necessary as the new system develops and as the customs and habits of the population become known.

It is generally recognized that municipal by-controlled collection is preferable to individual by-controlled collection since sanitation is probably better regulated.(8) (11) (12) (13) Removal service for entire communities can never be effective when left to the individual home owner or occupant to subscribe to the service. Such a system encourages the promiscuous throwing of garbage and refuse on the highways, in ditches and on vacant lots. As a result, an increasing number of cities are finding it necessary to provide municipal collections of garbage and refuse. A recent study in Ohio indicated a general trend toward municipal collection.(4) In Wisconsin, municipal collection has increased from 32 cities in 1936 to 78 cities in 1952.(9) In Minnesota, municipal collection is practiced in 38 cities while contract collection is in operation in 17 cities.(10)

Civic pride will probably never be developed to the point where every inhabitant will seek and demand an adequate service free from hazards and odor nuisance. In most states, positive legislation already exists which provides municipalities with power to establish safe and sanitary methods of refuse collection. While it is impossible to design a new or revamp an old collection system by a theoretical formula, there are several steps which may be followed in planning a system and which will aid in providing a satisfactory service. The following procedure is submitted as an aid in the establishment of a typical refuse collection system:

1. Institute planned routing and collection after completion of preliminary study.
2. Develop sanitary disposal methods and facilities within practicable

proximity of collection areas to minimize hauling mileage.

3. Install special purpose equipment to increase carrying capacity.

4. Enact a simple and direct ordinance with firm penalties for violation.

5. Attempt to obtain and enforce public compliance with the local ordinances.

6. Establish and maintain equitable pay rates to collection crews together with an incentive program.

7. Prosecute a continuous public relations policy.

8. Institute a simple but complete and economical system of maintaining records.

The following headings taken from the Rules and Regulations of the City of East Cleveland illustrate the scope of what is believed to be a model formulation of such regulations.

Section 483 - Definitions "a" to "j"
Section 484 - Exclusion of Waste Materials
Section 485 - Separation of Combustible and Non-Combustible Wastes
Section 486 - Garbage and Combustible Waste Containers.
Section 487 - Ash and Non-Combustible Waste Containers
Section 488 - Confiscation of Containers
Section 490 - Owners To Provide Containers
Section 491 - Garbage To Be Dry and Wrapped
Section 492 - Garbage To Be Placed In Containers Promptly
Section 493 - Large Combustible Waste
Section 494 - Special Combustible Waste
Section 495 - Extraordinary Combustible Waste
Section 496 - Extraordinary Non-Combustible Waste
Section 497 - Paints, Explosives, etc.
Section 498 - Depositing Garbage On Public Or Private Property
Section 499 - Depositing Other Waste on Public Or Private Property
Section 500 - Upsetting Waste Containers
Section 501 - Street Waste Receptacles
Section 502 - Origin of Waste Material
Section 503 - City Manager May Make Exceptions
Section 504 - Special Disposal at Incinerator
Section 505 - Private Collecting and Transporting of Waste
Section 506 - Licensing For Private Collection and Transport
Section 507 - Private Scavenging
Section 508 - Private Incineration
Section 509 - Garbage or Waste in Sewer System
Section 510 - Private Vehicles for Garbage, Manure, etc.
Section 511 - Vehicles With Offensive Lading
Section 512 - Vehicles - Storage and Cleaning
Section 513 - Vehicles for Other Waste
Section 514 - Manure Pit or Box
Section 515 - Removal of Manure
Section 516 - Maintenance of Pit or Box
Section 517 - Manure For Fertilizer "a" and "b"
Section 518 - Removal of Dead Animals
Section 519 - Right to Revise

Section 520 - Violations
Section 521 - Penalty For Violation
Section 522 - Inconsistent Legislation
Section 523 - Invalidity of a Part

Proper personnel for operation of a collection system is an important factor. The working conditions of men on the collection routes has improved considerably during the past few years. Perhaps the biggest boon to personnel in collection service has been shorter working hours, consideration of grievances, and appeal from dismissals. However, improved labor conditions have resulted in increased cost of operation.

Frequent labor turnover is also expensive and in many instances economies can be affected through reward for constant attendance and satisfactory work. Many municipalities have provided men with clothing, boots, and raincoats. There has been a trend by communities to place the collection force on an incentive basis which in many cases has improved conditions. The incentive method has been adopted and accepted more widely in recent years.

Good public relations play a fundamental part in regulating or operating any collection system. People in general are interested in service which is regular and complete. The best program for good service is regulation and completion of that service. The municipality actually does approximately 15% of the disposal service, the householder being responsible for the balance. When the community has become educated to this fact, and begins to cooperate, the system will definitely show improvement.

Equipment

A progress report on the development of the refuse collection vehicle, can best be accomplished with a description of the various types of vehicles that have been developed by the manufacturers of truck bodies.

These truck body manufacturers produce three general body types for the collection of refuse materials:

1. The enclosed body—loaded by hand
2. The enclosed body—loaded mechanically
3. The open body—loaded by hand

Some of the enclosed mechanically-loaded bodies are provided with mechanisms to compact the refuse as it is moved into the body of the truck.

Except for use in special situations, there seems to be a lessening demand for the enclosed body of the hand-loaded type. Present trends in most cities appears to be towards a greater use of the enclosed mechanically-loaded type truck. It reduces the manpower burden for loading and when a compactor is provided, a greater quantity of materials can be carried in a given body space.

The mechanical loader is manufactured in two general types—the batch-hopper and the continuous-belt loader.

The batch or hopper loader has a hopper built integral with the body with its capacity at something less than one cubic yard. Refuse material

is placed in the hopper by members of the loading crew and a hydraulic powered loading mechanism then pushes the material into the truck body.

Two manufacturers offer a batch type truck, where the filled hopper is lifted to the top of the truck by means of radial arms where the hopper tips, discharging its contents through an opening in the top of the body. One of these is equipped with a compacting device. The batch type requires a time cycle of from 20 to 40 seconds in order to move a batch of materials into the body. During this period, loading or refuse must be halted.

The continuous-loader type makes use of a conveyor belt to lift materials high into the truck. Since the operation of loading in this case is a continuous one, interruptions in the loading becomes unnecessary. A compactor mechanism pushes the refuse forward towards the front of the truck body.

The mechanical-loader truck has of course reduced the loading burden. However, field observations indicate little opportunity for reducing the number of men to constitute the loading crew. This truck's design reduces the loading height as much as 12 inches, and when it is equipped with the compacting feature, approximately 1-1/3 cubic yards of refuse can be compressed to a volume of about one cubic yard. This compacting ratio will go up to 2:1 and more for materials with a high content of paper and cardboard such as is often collected from retail trade establishments. Unit weights for the compressed materials will increase about one hundred pounds per cubic yard.

Claims for speeding up of the collection operation with the use of the mechanical batch loader do not seem to be borne out under normal operating conditions in the field. Under optimum conditions of a test run, a saving of time can be shown. But observations made during the time period required to dump the hopper's load show that any time saved is largely nullified by "waiting" periods (the loading crews are prone to "rest" rather than engage themselves in readying materials for the batch loader).

Compared with the open body truck, the mechanical loader has a higher first cost. Maintenance of its mechanism will cost more and since this type body has the greater dead load, a heavier chassis must be provided for a given capacity.

Although the compaction feature will increase the density of materials, field observations have noted a tendency to fail to make full use of the truck's potential capacity.

Its operating mechanism is somewhat noisy, worthy of mention in cities which employ early morning collections in residential districts. The aesthetic advantage of the enclosed body and the acceptability of its sanitary features are obvious.

The open body truck is "old reliable" for the refuse collection service. But so far as known, "muscle power" alone is the means used to elevate materials from ground level to the truck's body. Likewise, the compactor mechanism appears to be non-existent for this truck.

The loading height for the open truck is greater than for most of the mechanical loaders but this can be reduced in effect by the use of folding

steps, iron ladders fixed to the body sides and with installation of hinged sideboards to be folded down until materials have been loaded to hinge level.

The present ratio in the use of mechanical loaders to that of open trucks is about 1:3 with the trend towards greater use of the former. But the eventual and total replacement of the open body is considered to be highly doubtful.

First cost for the open truck is less, and the cost to maintain it is less. A lighter chassis, per unit of body capacity, can be specified for its lighter dead load.

Operation of an open truck is comparatively noise-free except when members of the loading crew may be given to an excess of working exuberance.

Not of least importance is the "stretch ability" of an open truck's rated capacity. Vertical stacking of refuse materials at the time when collectors near the end of an assignment or when approaching the end of the work shift is an advantage of considerable importance.

Proper use of tarpaulin covers should eliminate most nuisances while the materials are in transit to the point of disposal.

One other piece of equipment used in the collection of refuse materials and worthy of mention is the steel bin designed for pickup and transport by a truck chassis equipped with the necessary special lifting device.

The capacity of this bin, made in many models for many types of materials, ranges from six to twelve cubic yards. It is fully enclosed, watertight, and has access doors for loading.

This piece of equipment has many advantages in its use for the collection of refuse. In a collection district where conditions make it difficult for collection crews to render individual servicings, one of these units can be set up for use by groups of business establishments or residents. A regular schedule for pick-up when full, with replacement with an empty bin, has the result of reducing the municipal operation to a pick-up of the unit and disposal of its contents by a truck and its driver.

There are many other applications in the refuse collection service where these bins can also be used to advantage for temporary storage and disposal of materials. Its use by municipalities is reported to be on the increase!

Reports and Records

This portion of the report is not intended for the purpose of designing forms but rather to set up an objective for the economical maintenance of adequate records. Records should be simple, explicit, and frequent enough to permit administrative study and control.

Maintenance of records is a costly operation and therefore a recurring survey of their usefulness should be made at least annually. For the operating staff they should be in sufficient detail to permit measurement of work load and output. The records are tools of planning and organizing. Planning and organization are functions of the budget structure and provide through adequate records, for financial and operational

controls. Specifically the supervisors of the organization should have reporting that permits maintenance of records with respect to Personnel, Financing and Operations.

Personnel records should provide data showing attendance, conduct, payroll information and provide adequate tools for the administration of personnel policies.

Financial records for supervisors should consist of those items that enable the head of the division or department to determine his financial status with respect to his budget. Closely related to the budget is the unit cost of operation. Therefore adequate reporting is a must in any Sanitation Department. The reporting must be such that permits ready interpretation of the unit cost status for each of the principal operations in the department.

Operational records should be basically derived from quantity reports and should be so designed as to permit evaluation and alteration of work loads as the need is indicated. There are several factors entering the study of work loads:

1. Length of routes which are determined by population density and refuse production per unit of population.
2. Units of population which may be residential, business, manufacturing, etc.
3. Number of stops per route.
4. Time required to collect and dispose of a given quantity of refuse.
5. Number and size of crews best suited economically for the operation.
6. Type of equipment used and location of disposal point with respect to center of haul on each route.
7. Frequency of collection as required by local policy or ordinance.

Historical data should be maintained for comparative purposes to support and measure the need for implementing and revising the current organization. These data should be informative and should be in such form as to permit the department head to evaluate the efficiency of his department.

The development of forms varies with each municipality or agency depending on organization and responsibility. Where one city may have a central office for accumulation of financial data another may not, hence the forms to be used will vary accordingly.

Reports should be such that effective Public Relations can be maintained. Therefore, records of complaints showing causes, effects and corrective steps must be maintained in the Department.

Reporting responsibilities for the City of San Diego, California are assigned to the Foreman, the General Foreman and the clerical staff. An outline of this city's reporting is submitted for use as a guide.

Foreman

Daily Report of activity within his responsibility

1. Personnel records and time cards
2. Truck miles
3. Tonnage
4. Delivery of Garbage to Contractor
5. Complaint responses and dispositions

Activities Reported on:

1. Garbage Collection and Disposal
2. Rubbish Collection and Disposal
3. Beach Cleaning
4. Dead Animal Collection
5. Operation of Sanitary Fills

General Foremen

Reviews reports, problems and overall activity within his responsibility. Makes general report to Superintendent covering special or extraordinary conditions.

1. Crew activity
2. Equipment Operation
3. Total Quantities

Clerical Staff

Consolidates Daily reports onto permanent records
Prepares payroll and personnel reports and forms
Receives and routes complaints
Prepares daily, weekly and monthly reports
Reviews cost reports from Auditor
Consolidates the data for annual budget preparation

Superintendent

Reviews daily activity reports
Weekly quantity reports
Monthly cost reports
Prepares monthly activity report for director which includes:

1. Personnel
   (a) Absenteeism
   (b) Sick leave usage
   (c) Total number of people budgeted and actual
2. Quantities
3. Review of Complaints
4. General Activity Report

Prepares Annual Report of the Division

Director

Reviews reports with respect to working standards
Discusses plans for improvements

1. Methods
2. Routes
3. Complaint reductions
4. Personnel Management
5. Financial control

CONCLUSIONS

Conclusions, based on the study and research completed by the Task Committee on Collection, are:

1. A preponderance of small communities (under 10,000 population) have either no collection system, or an inadequate and unsatisfactory system. Generally speaking, inhabitants who have

knowledge of the collection system of these communities regard their system as fair, poor or unsatisfactory.

2. Legislation and statutes at the municipal level should be revised and adjusted to meet modern trends and improvements. Many neglect to mention the use of individual garbage grinders.
3. The enforcement of regulatory ordinances and regulations is the responsibility of municipal officials.

   Municipal officials must recognize their responsibility in the matter of this service requirement. They should resolve to spend money on this service and place a high priority on the accomplishment of an approved system. Regular collections must be maintained to provide clean and sanitary conditions.
4. Refuse collection has greatly increased in cost in the past decade. The best plan for financing a collection system is from general revenue, since it assures complete service while being based on ability to pay.
5. A need exists for active and intensive interest in the subject by universities and health authorities.
6. Collection by municipal forces is preferred because of controlled sanitation.
7. Refuse collection should be subject to engineering analysis, study and investigation. It is improbable that a standard method can be devised from which a collection system can be designed. Each community presents a distinct and separate problem.
8. Public sentiment is in general opposed to transportation of garbage by open trucks. Manufacturers of collection equipment should offer more demonstrations to municipalities, and should maintain continuous research on their equipment to provide communities with vehicles which best fit their sanitary and economical requirements.
9. A continuous program of public relations and education is beneficial in improving co-operation from the public. Provision by the public of adequate containers would improve most existing collection systems.
10. A system of reporting and records by the municipality must be utilized to provide efficient management.

Respectfully submitted,

Norman W. Nester, Chairman — Jean L. Vincenz
John P. Flockhart — V. A. Parker

Subcommittee of the Sanitary Engineering Division on Refuse Collection

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